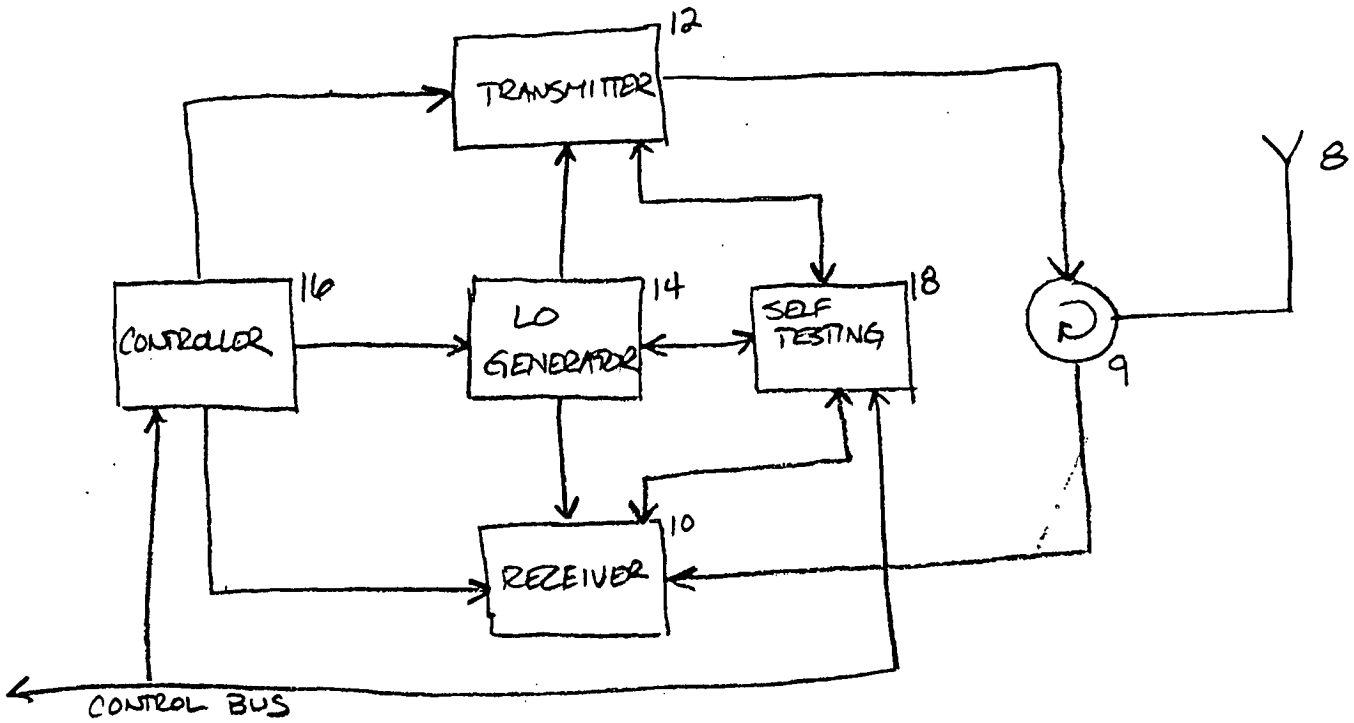


FIG. 1

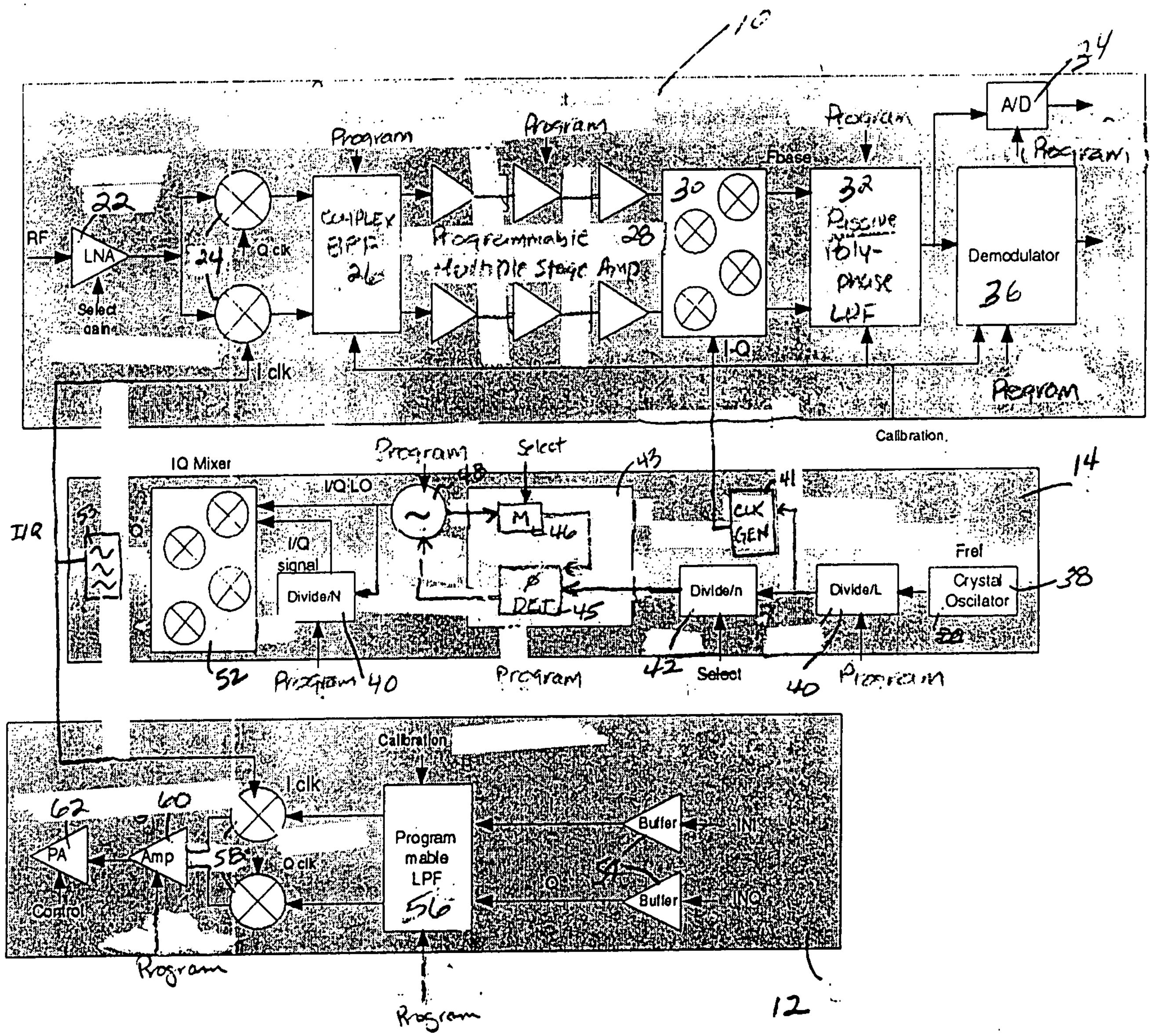

10
24
A/D
Program
Program
Program
Program
Fbase
30
32
Passive
Poly-
phase
LPF
Demodulator
36
RF
22
LNA
Select
gain
24
Q clk
COMPLEX
BPF
26
Programmable
Multiple Stage Amp
28
I-Q
I clk
Program
Calibration
14
IQ Mixer
I/Q LO
Program
48
Select
43
41
CLK
GEN
M
46
I/Q
signal
Divide/N
φ
DET
45
Divide/n
Divide/L
Fref
Crystal
Oscilator
38
I/Q
53
52
Program
40
Program
42
Select
40
Program
Calibration
I clk
62
60
PA
Amp
58
Q clk
Control
Program
mable
LPF
56
Buffer
Buffer
IN I
IN Q
54
Program
Program
12

FIG. 2

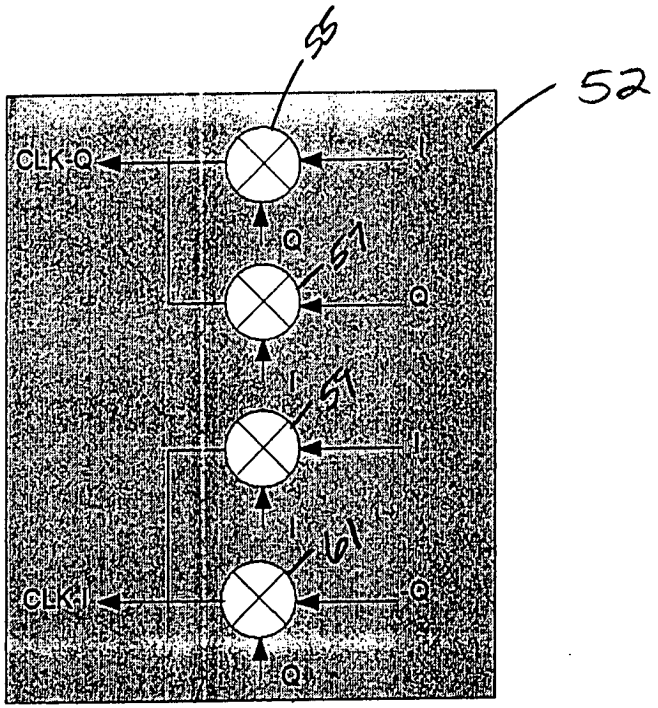


FIG. 3

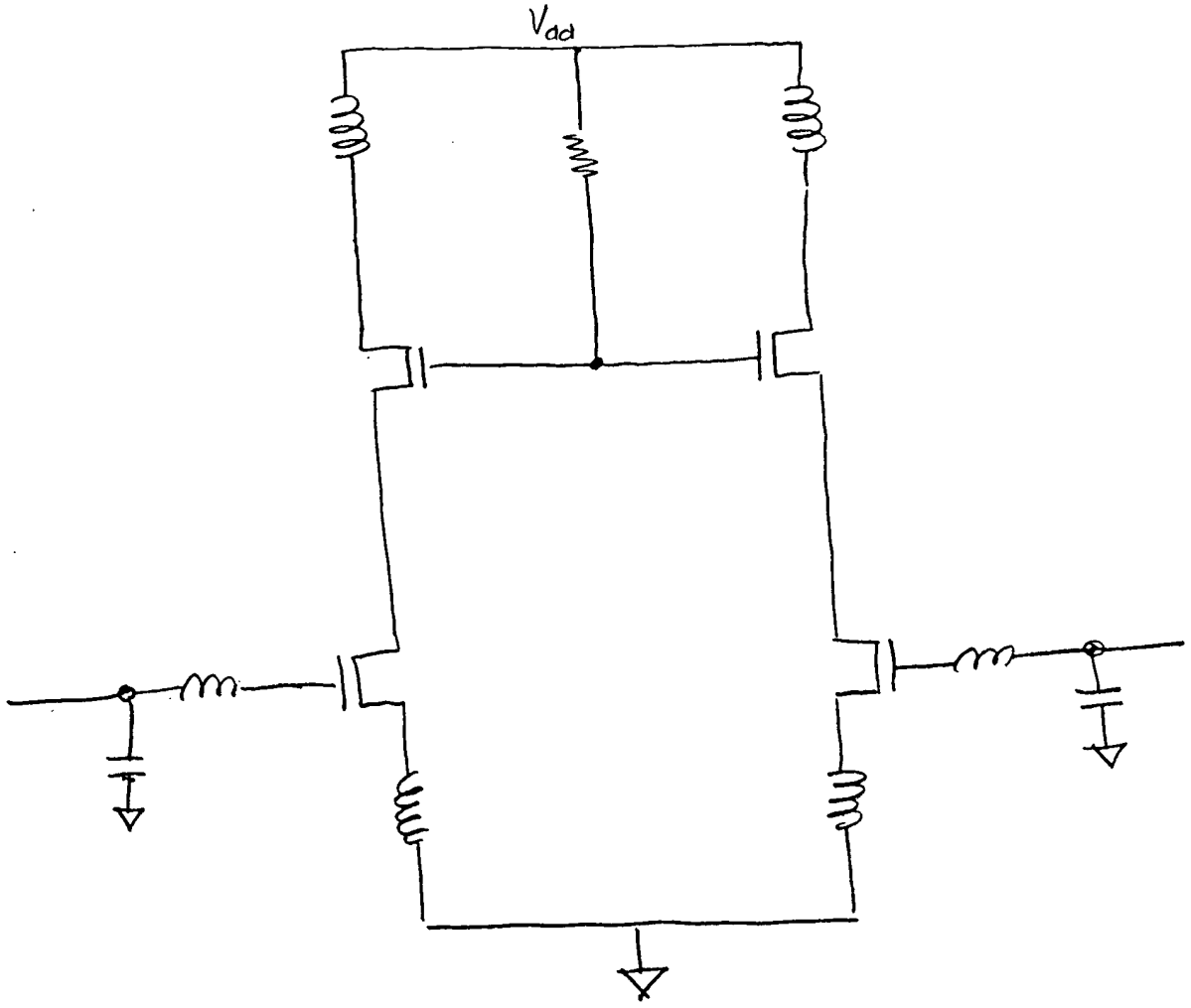


FIG. 4(a)

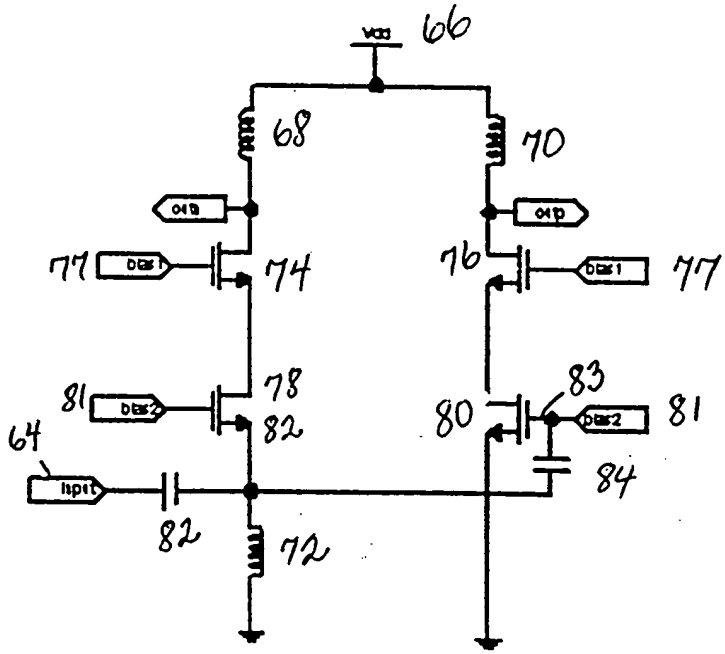

Vdd
66
68
70
outn
outp
77
bias1
74
76
bias1
77
81
bias2
78
82
83
80
bias2
81
64
inpt
82
84
72

FIG. 4

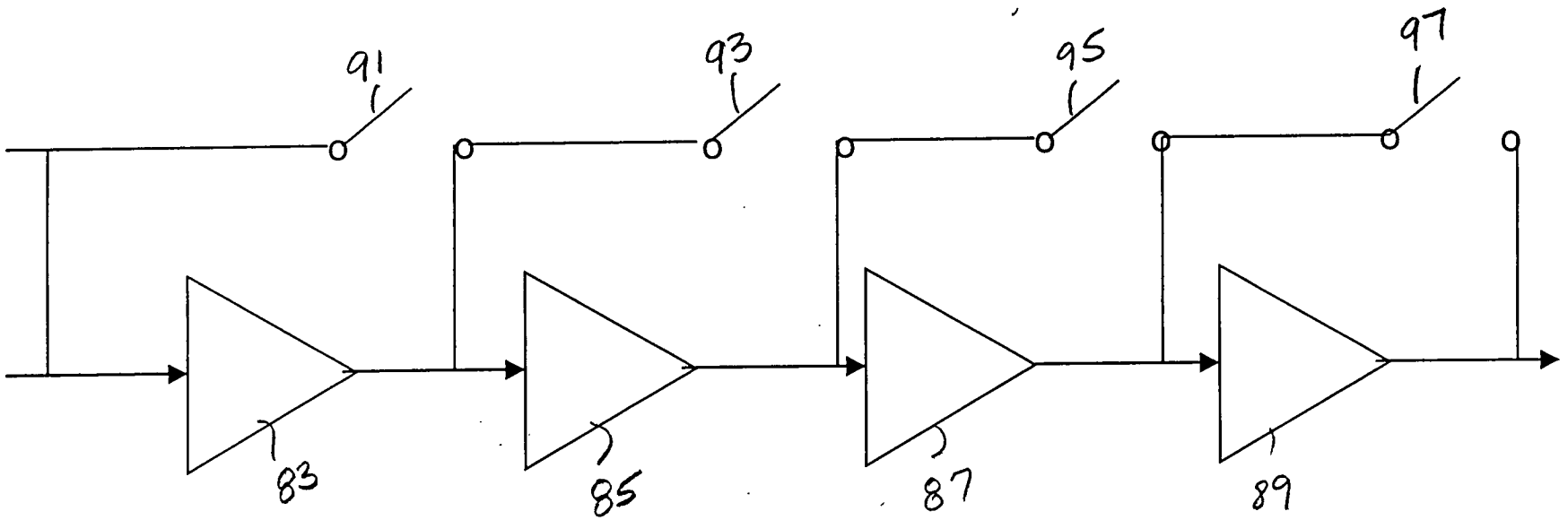


FIG. 5

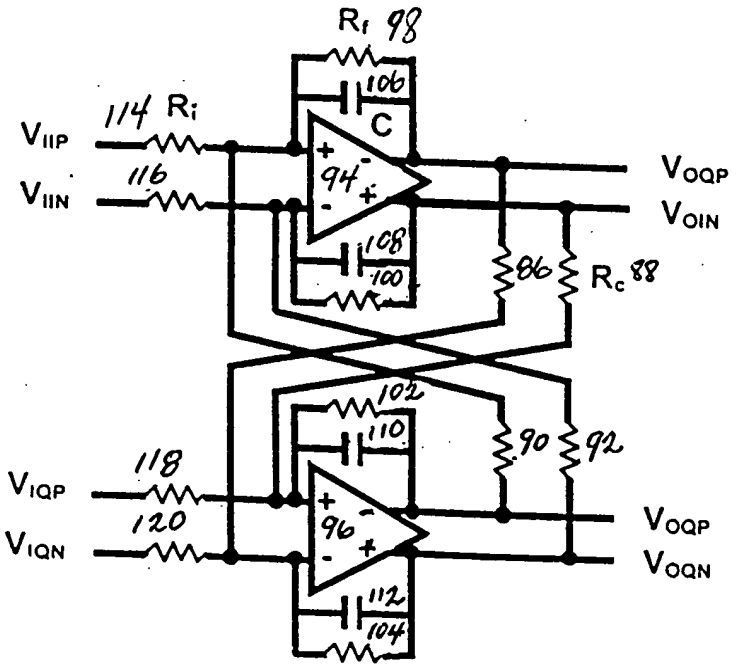

R_f 98
106
C
114 R_i
V_{IIP}
116
V_{IIN}
94
108
100
86
R_c 88
V_{OQP}
V_{OIN}
102
110
90
92
118
V_{IQP}
120
V_{IQN}
96
V_{OQP}
V_{OQN}
112
104

FIG. 6

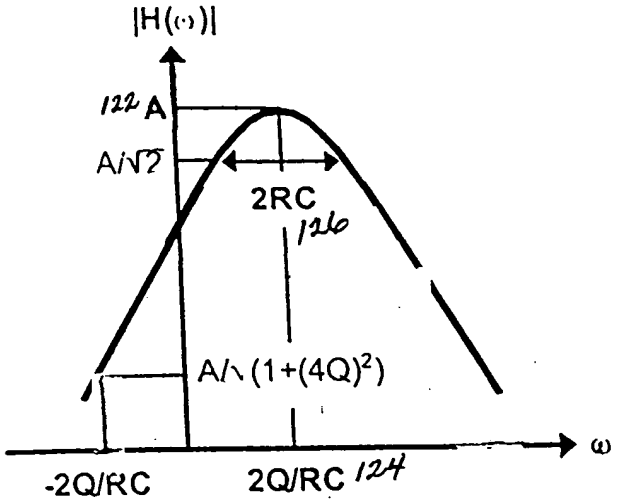


FIG. 7

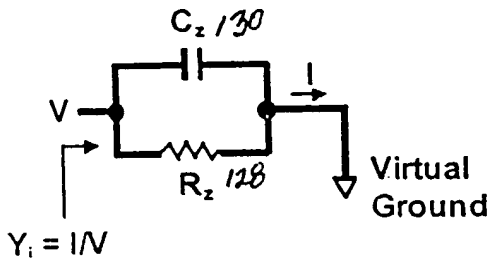


FIG. 8

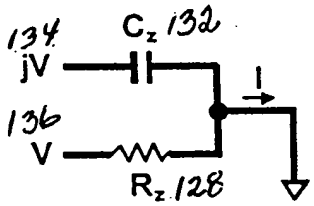


FIG. 9

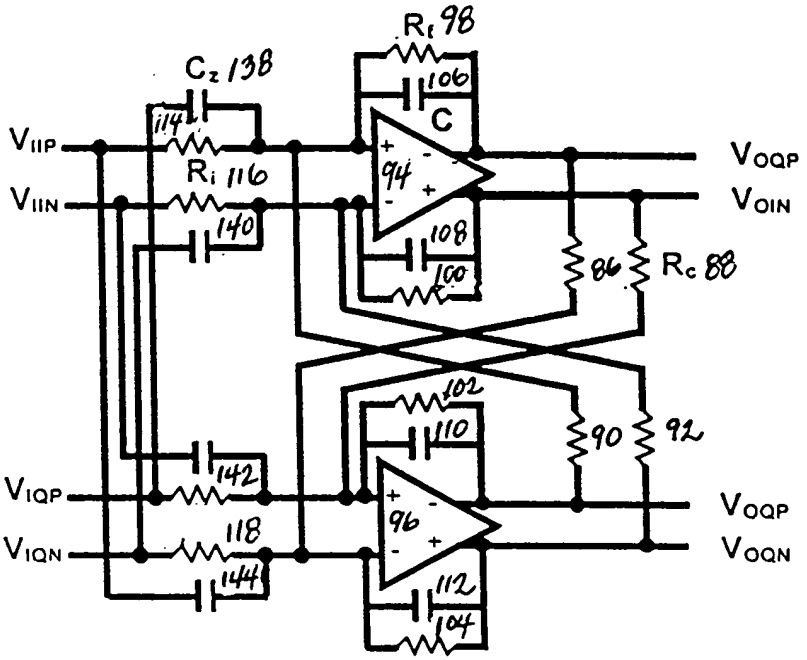

R_f 98
C_z 138
106
C
114
V_{IIP}
R_i 116
V_{IIN}
140
94
108
100
86
R_c 88
V_{OQP}
V_{OIN}
102
110
90
92
142
V_{IQP}
118
V_{IQN}
144
96
112
104
V_{OQP}
V_{OQN}

FIG. 10

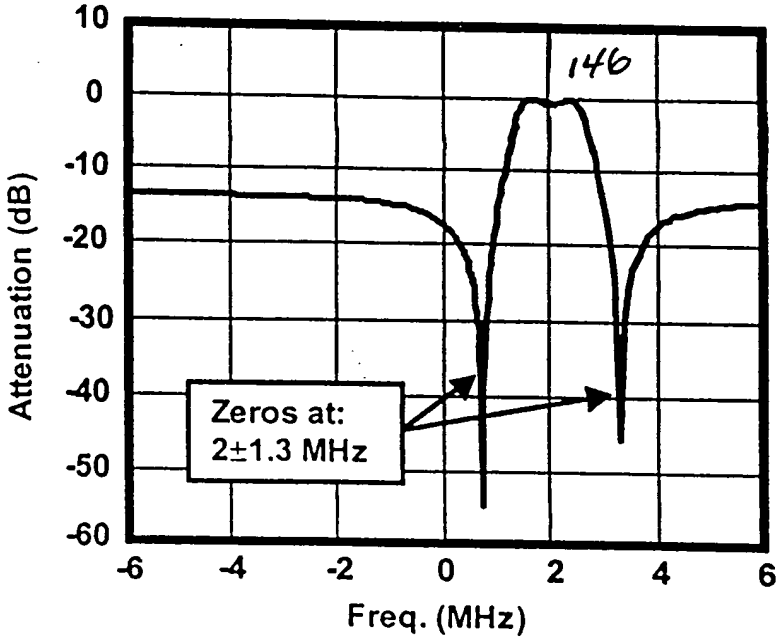

10
0
-10
-20
-30
-40
-50
-60
Attenuation (dB)
-6
-4
-2
0
2
4
6
Freq. (MHz)
146
Zeros at:
2±1.3 MHz

FIG. 11

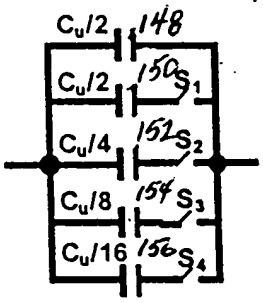


FIG. 12(a)

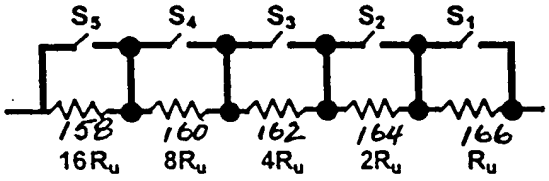


FIG. 12(b)

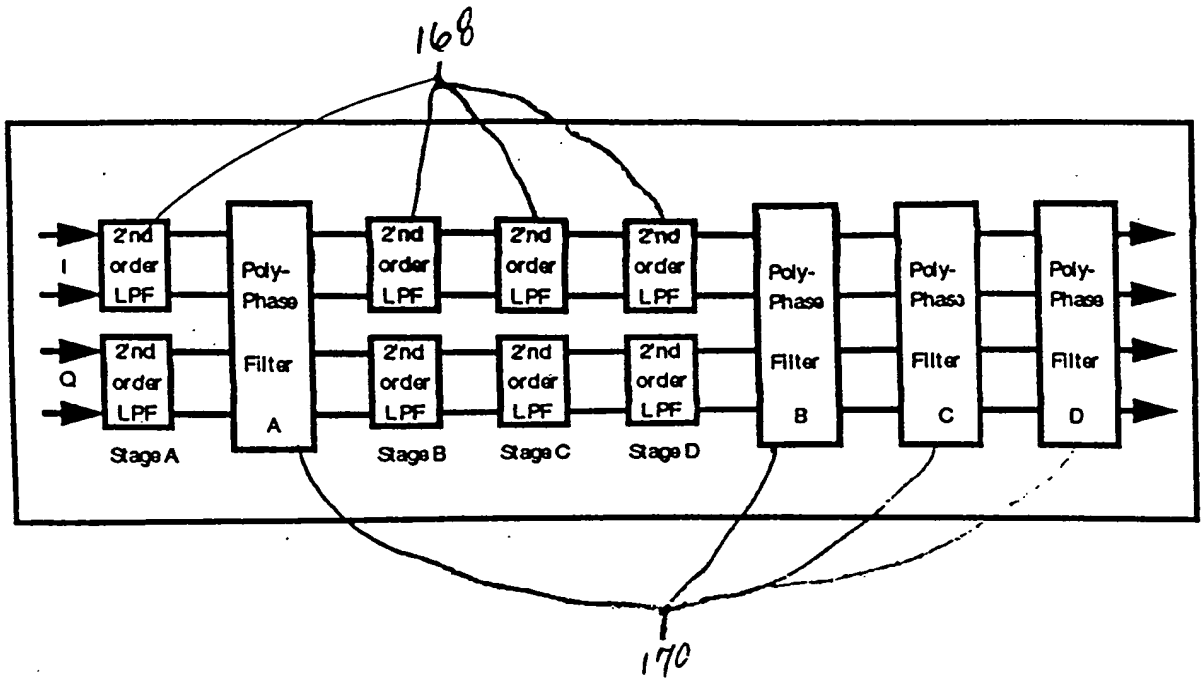

168
I
Q
2nd order LPF
Poly-Phase Filter A
Poly-Phase Filter B
Poly-Phase Filter C
Poly-Phase Filter D
Stage A
Stage B
Stage C
Stage D
170

FIG. 13

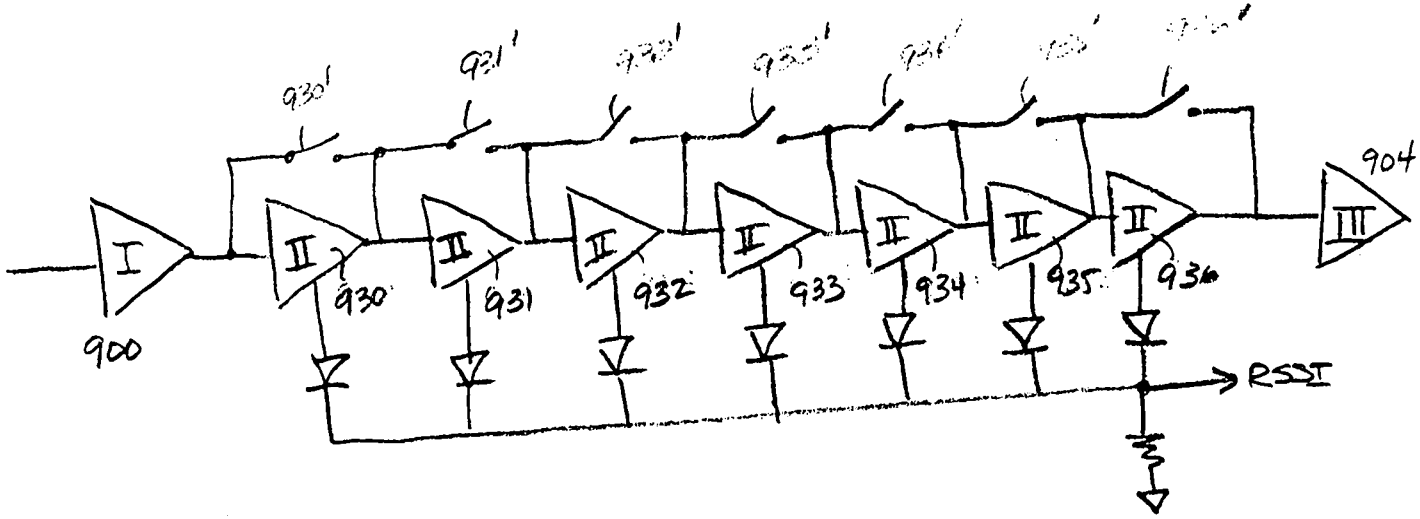

930'
931'
I
II
II
II
II
II
II
III
904
900
930
931
932
933
934
935
936
RSSI

FIG. 14

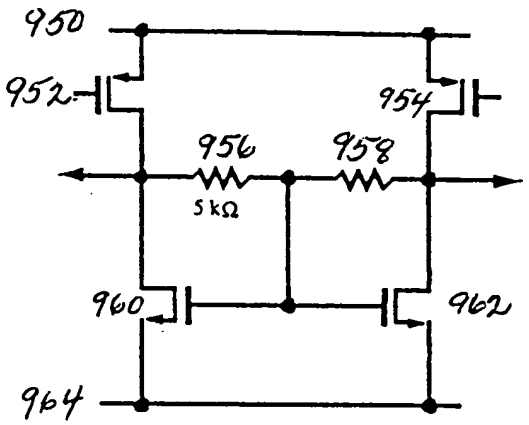


FIG. 15

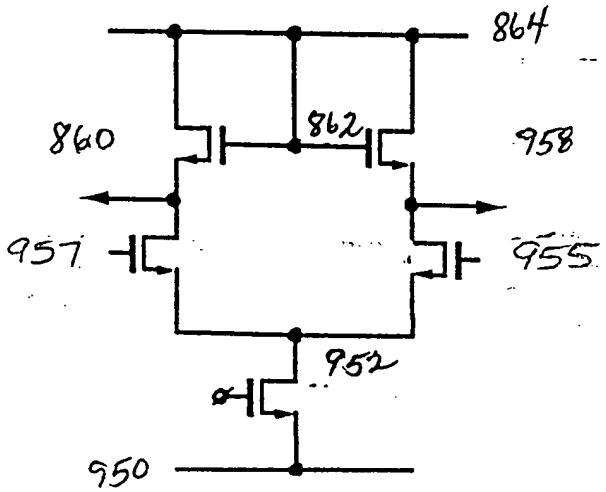


FIG. 16(a)

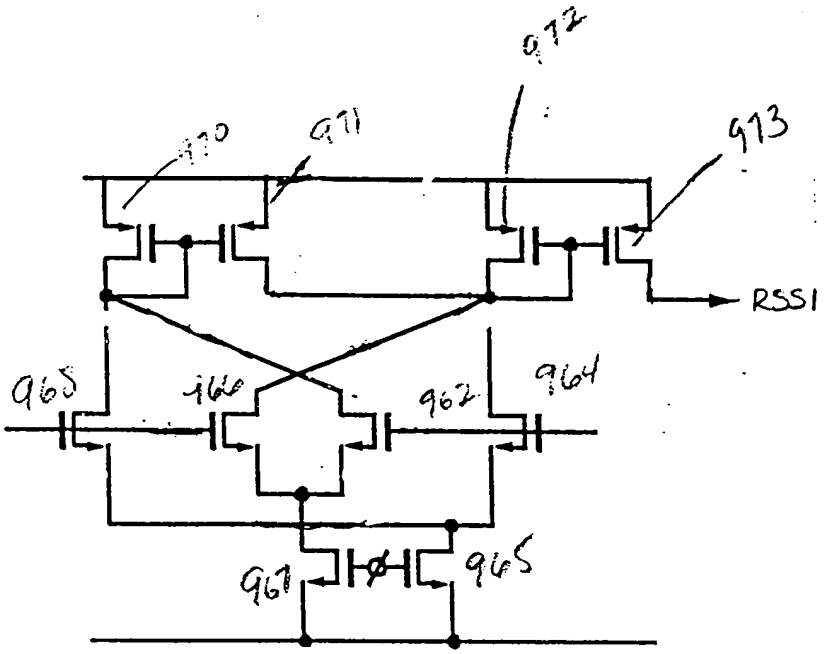


FIG. 16(b)

FIG. 17(a)

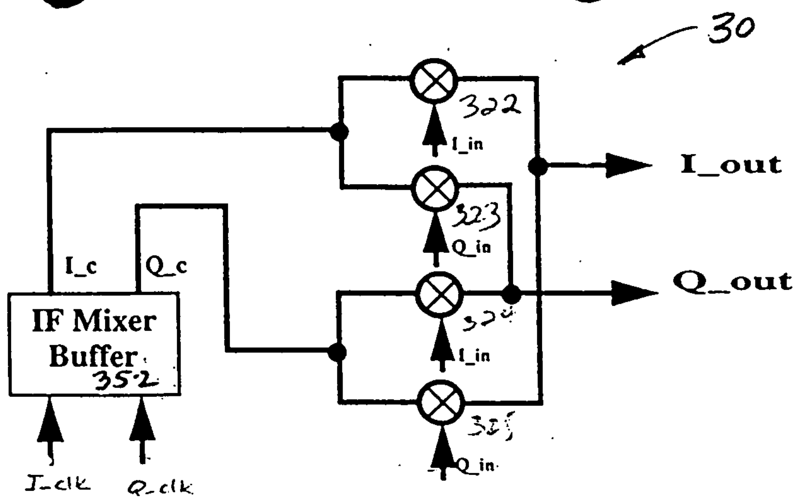
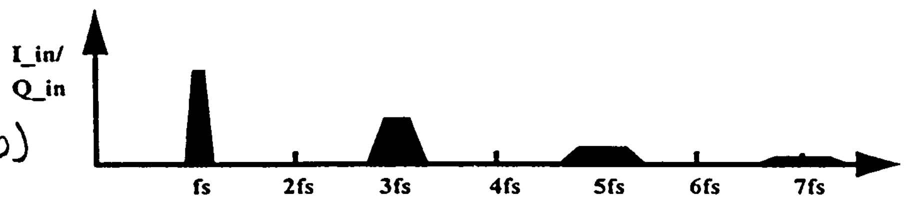
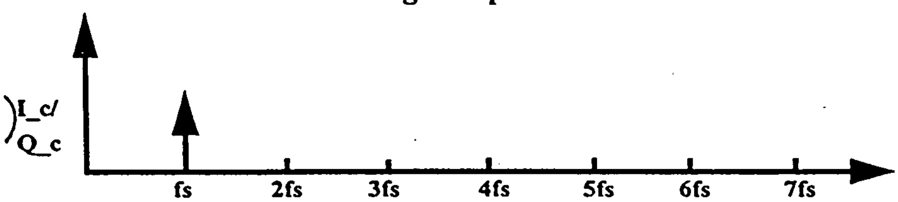


FIG. 17(b)



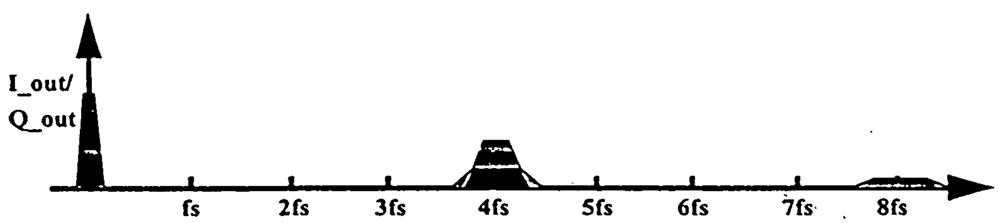
Limited IF Signal Spectrum

FIG. 17(c)



Sinusoidal Input Spectrum

FIG. 17(d)



IF MixerOutput Spectrum

FIG. 18

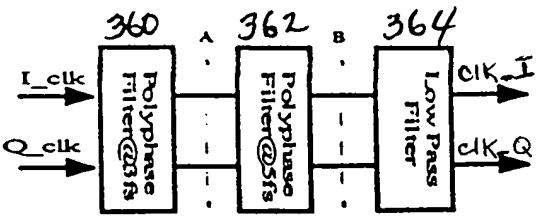
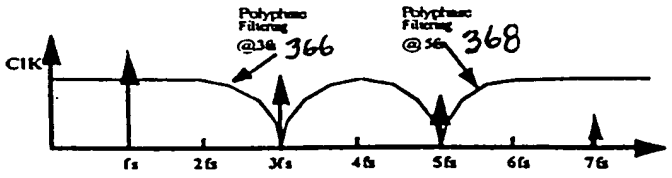
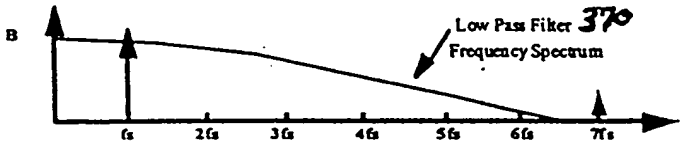


FIG. 19(a)



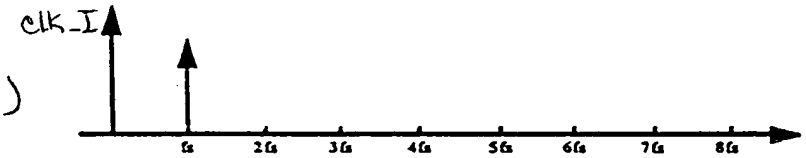
Differential Input Clock Signal Spectrum

FIG. 19(b)

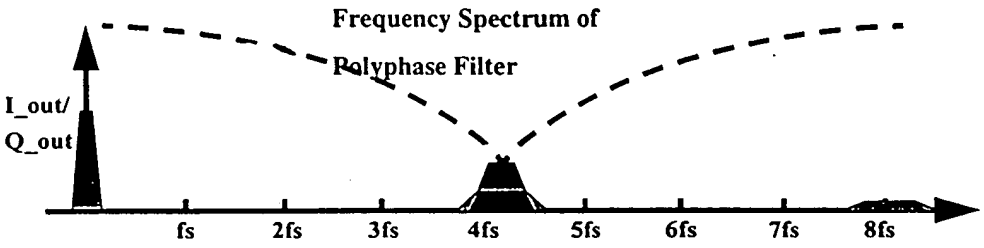


Signal Spectrum After 3fs and 5fs Polyphase

FIG. 19(c)

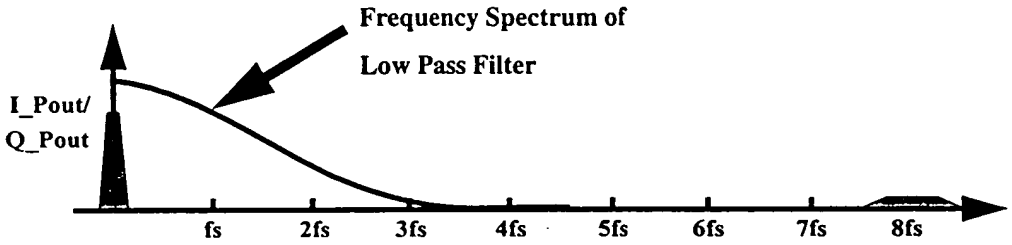


Sinusoidal Signal Generation After Low Pass Filter



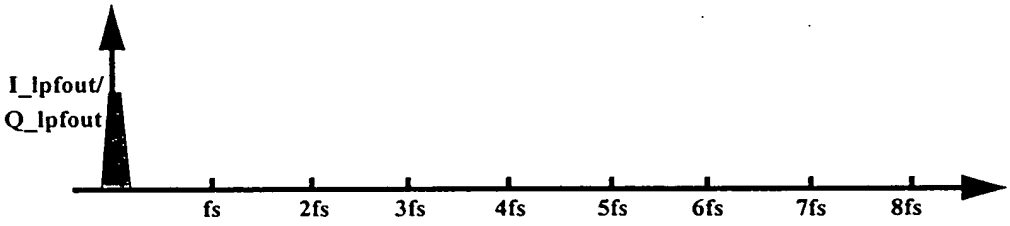
Signal Spectrum at Polyphase Input

FIG. 20(a)



Signal Spectrum at Polyphase Output

FIG. 20(b)



Signal Spectrum at Low Pass Filter Output

FIG. 20(c)

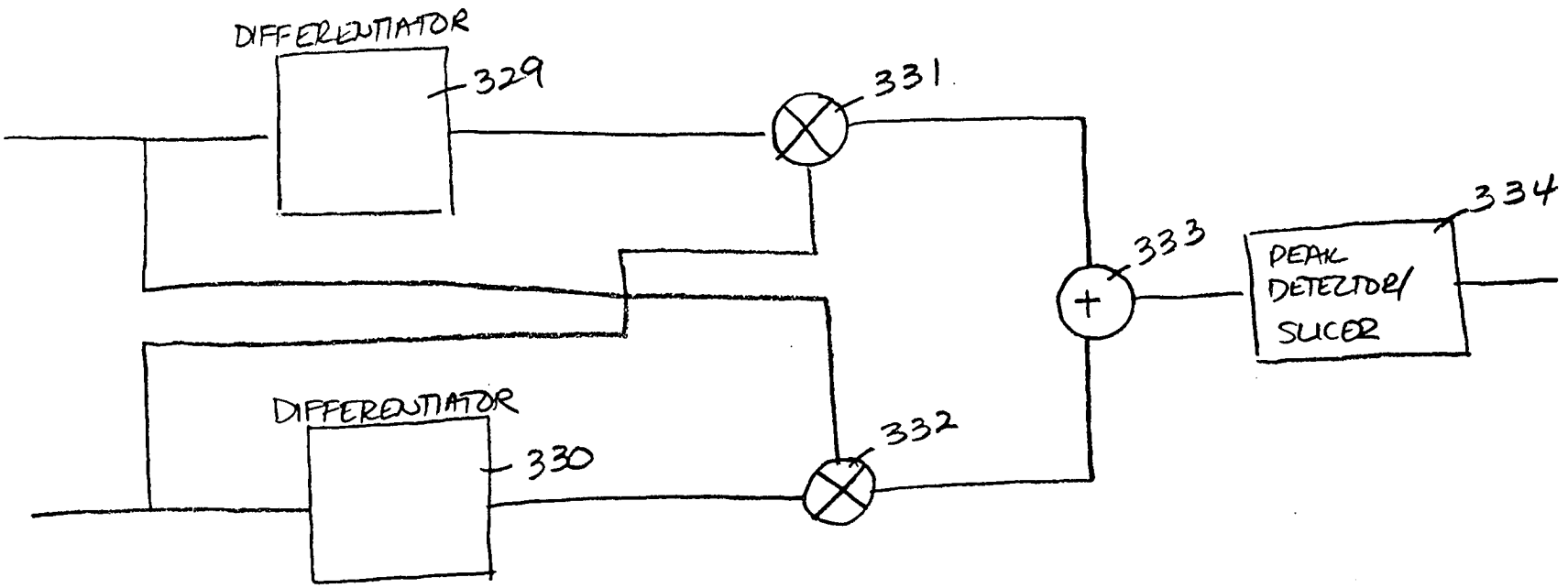

DIFFERENTIATOR
329
331
334
333
PEAK DETECTOR/ SLICER
DIFFERENTIATOR
330
332

FIG. 21

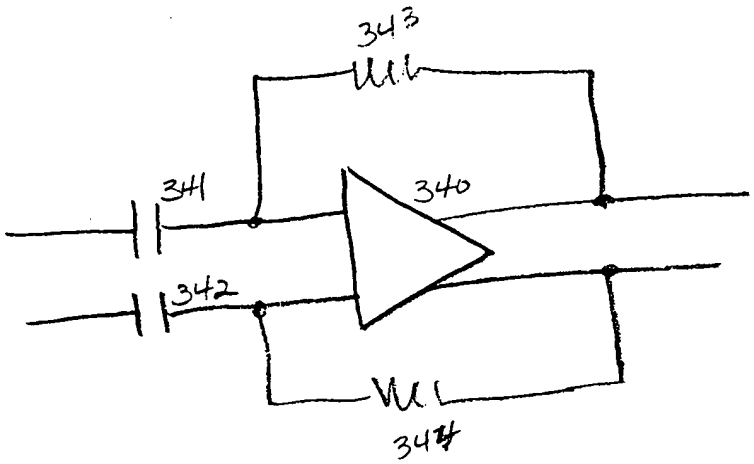


FIGURE 22

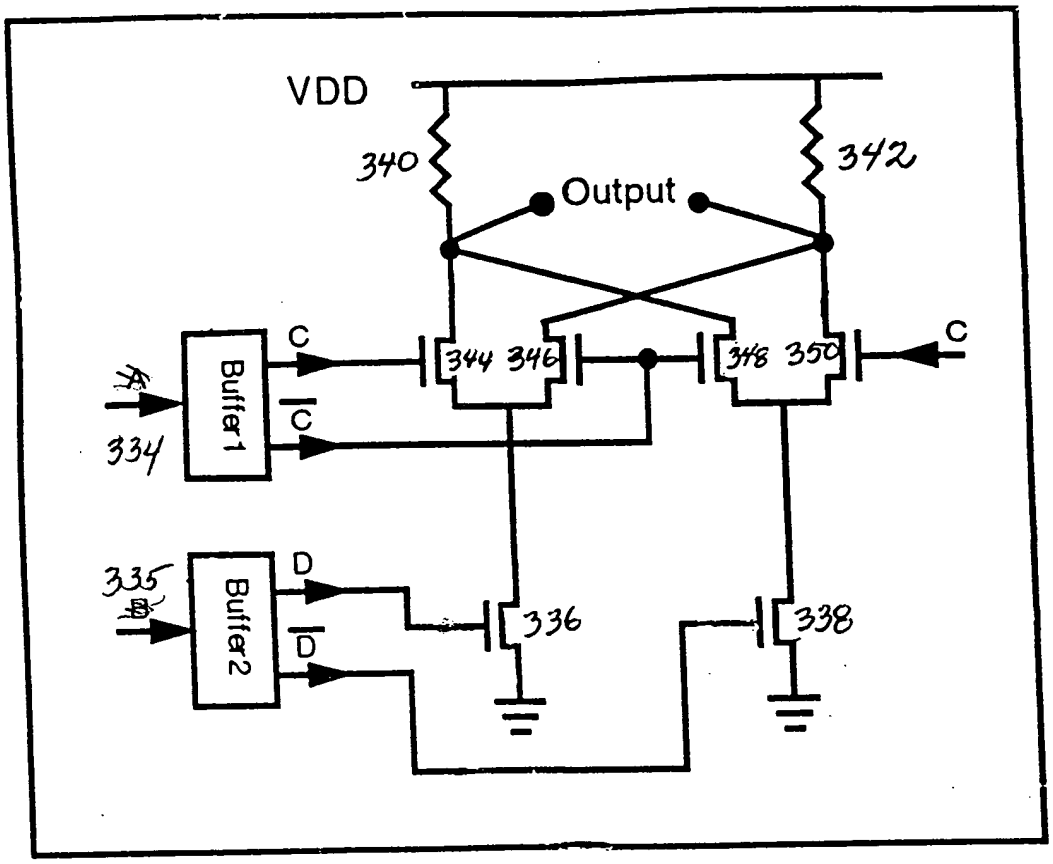

VDD
340
342
Output
C
344
346
348
350
C
Buffer1
C
334
335
Buffer2
D
D
336
338

FIG. 23

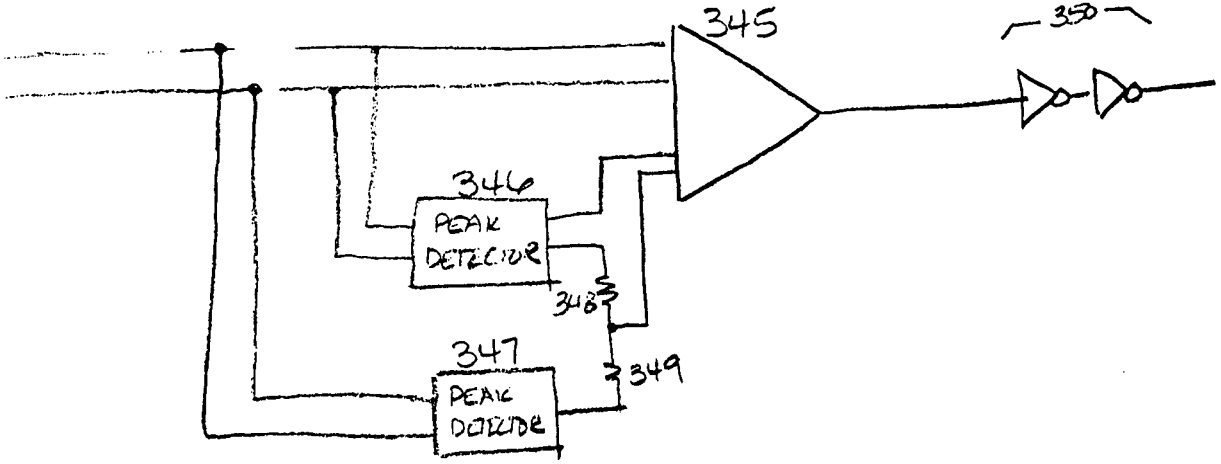


FIGURE 24

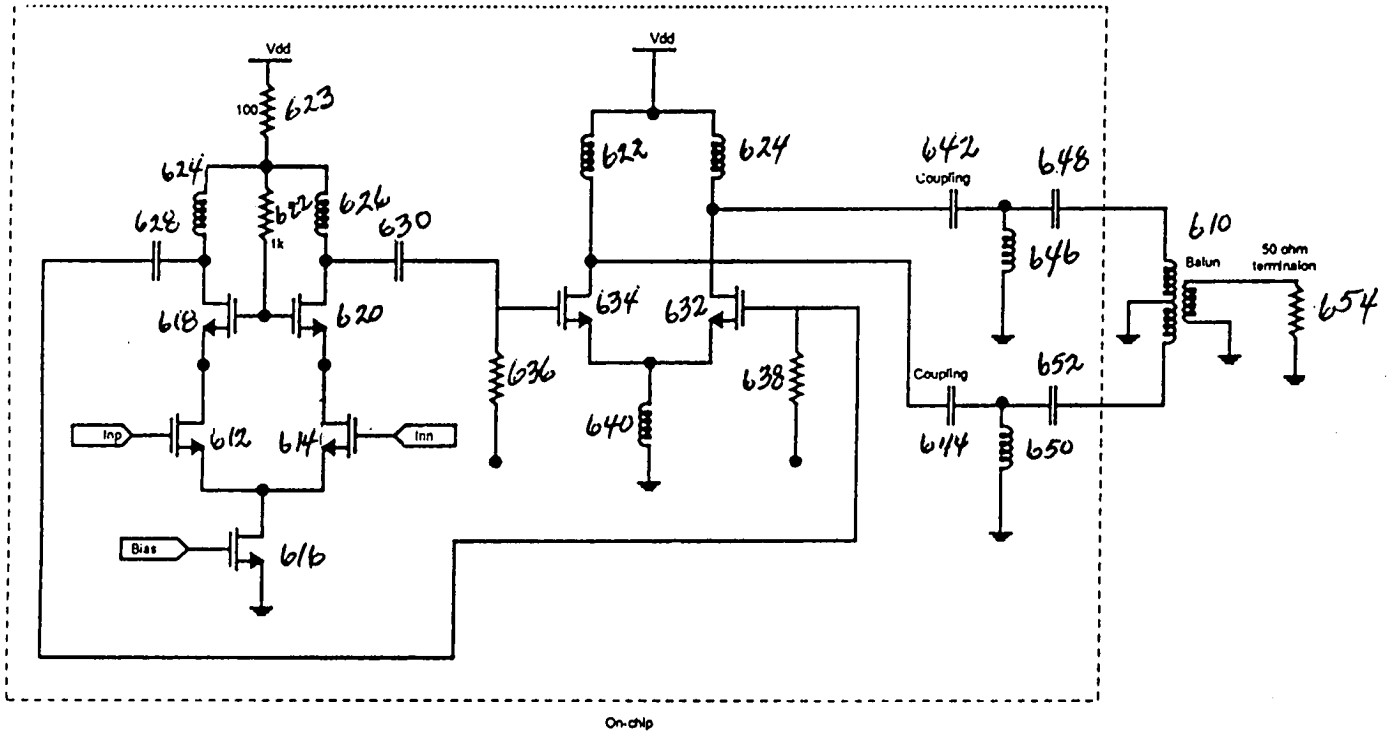

Vdd
100
623
624
628
622
1k
626
630
618
620
Inp
612
614
Inn
Bias
616
636
Vdd
622
624
634
632
638
640
642
Coupling
648
646
610
Balun
50 ohm
termination
654
Coupling
652
614
650
On-chip

FIG. 25

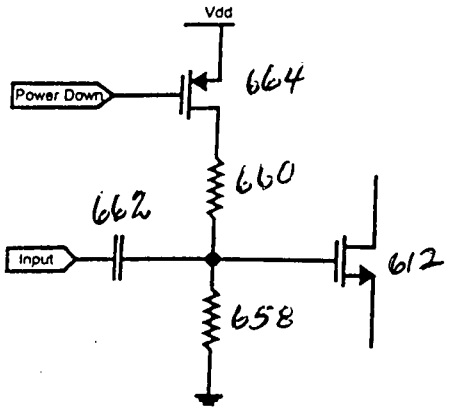


FIG. 26(a)

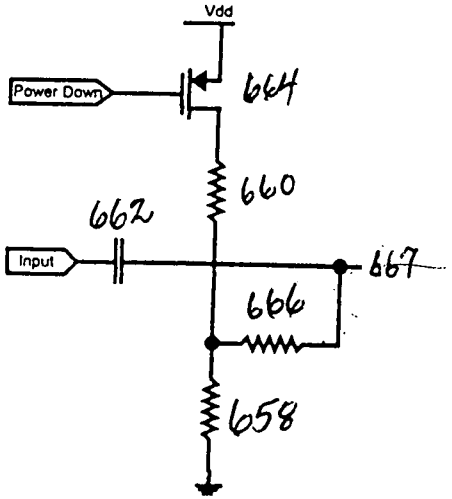


FIG. 26(b)

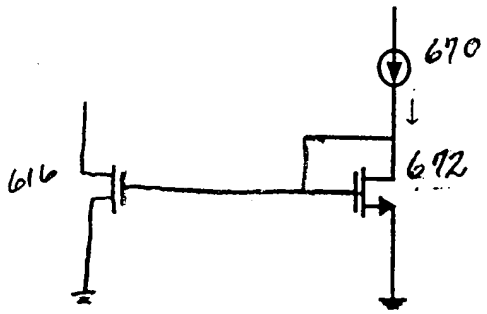


FIG. 27

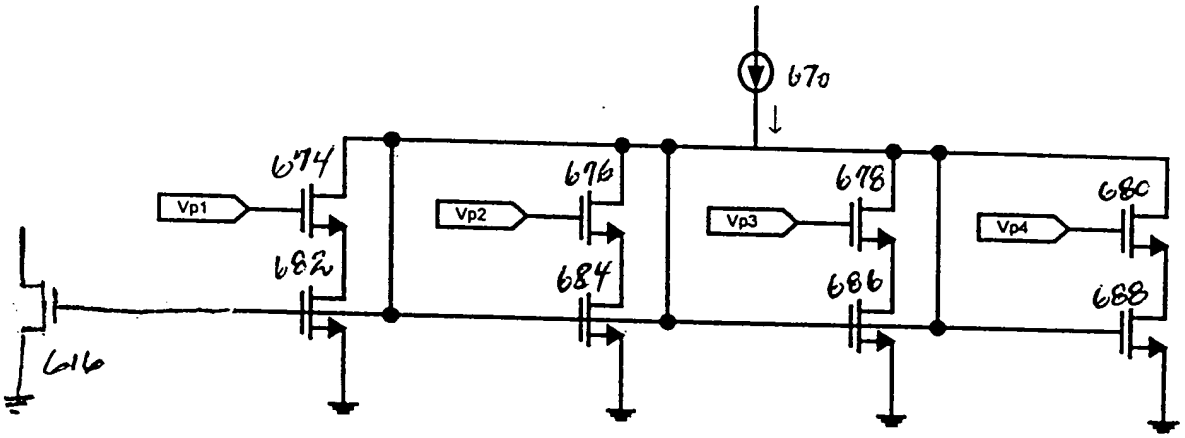


FIG. 28

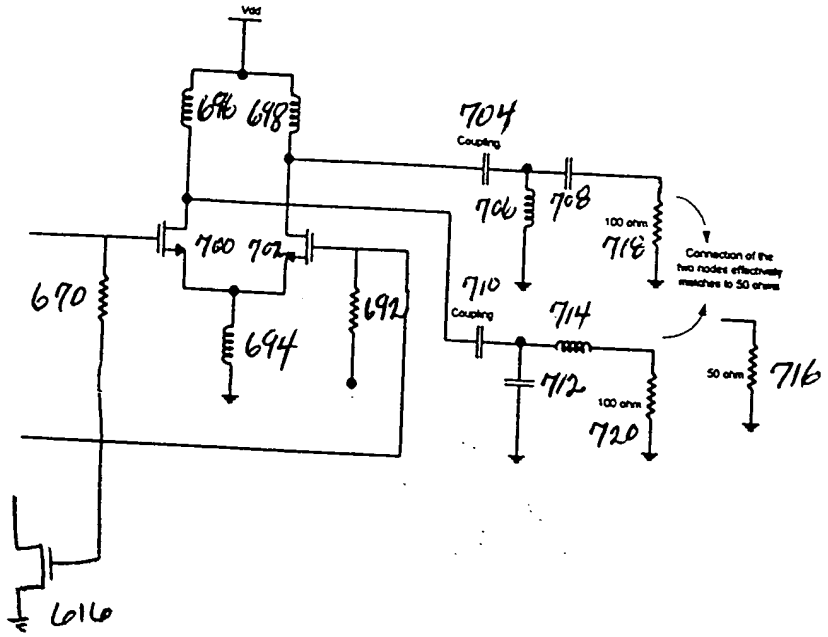

Vdd
696
698
704
Coupling
706
708
100 ohm
716
Connection of the two nodes effectively matches to 50 ohms
700
702
670
710
Coupling
714
692
694
712
100 ohm
720
50 ohm
716
6016

FIG. 29

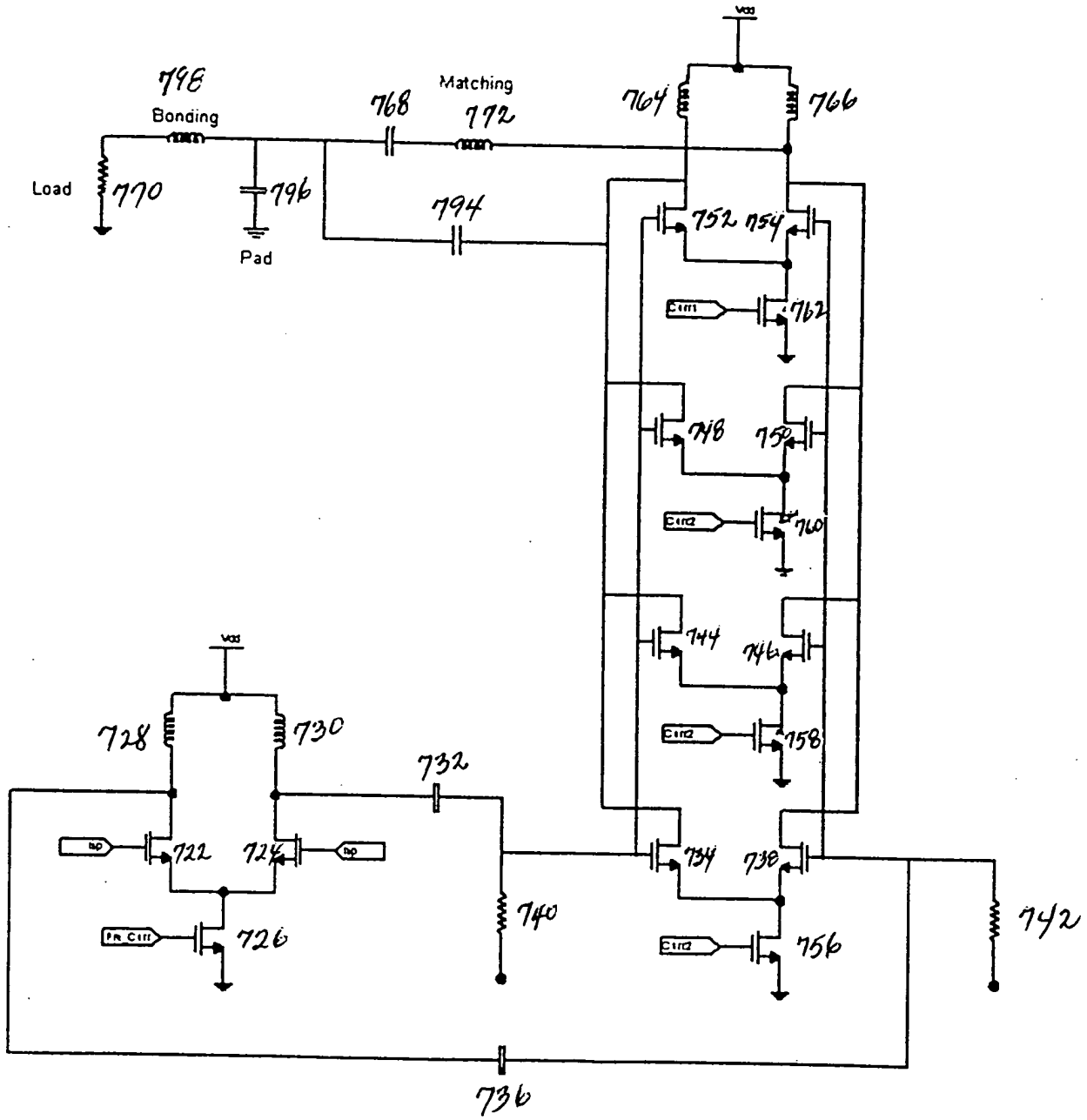

Vdd
798
Bonding
768
Matching
772
764
766
Load
770
796
Pad
794
752
754
762
748
750
760
744
746
758
Vdd
728
730
732
722
724
726
734
738
740
742
756
736

FIG. 30

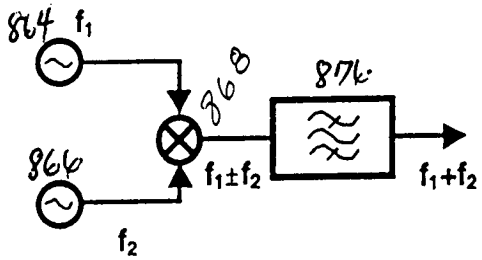


FIG. 31 (a)

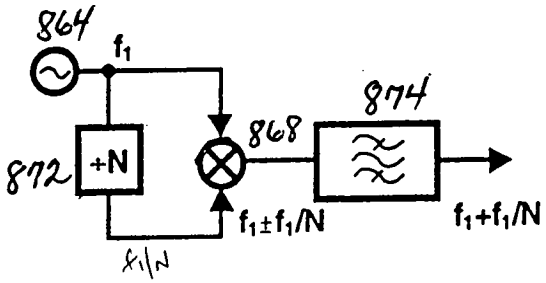


FIG. 31 (b)

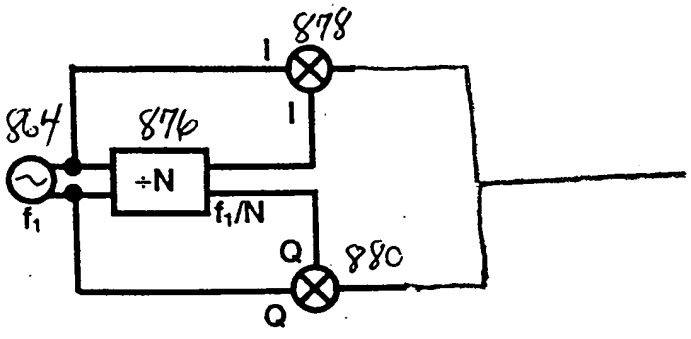


FIG. 32

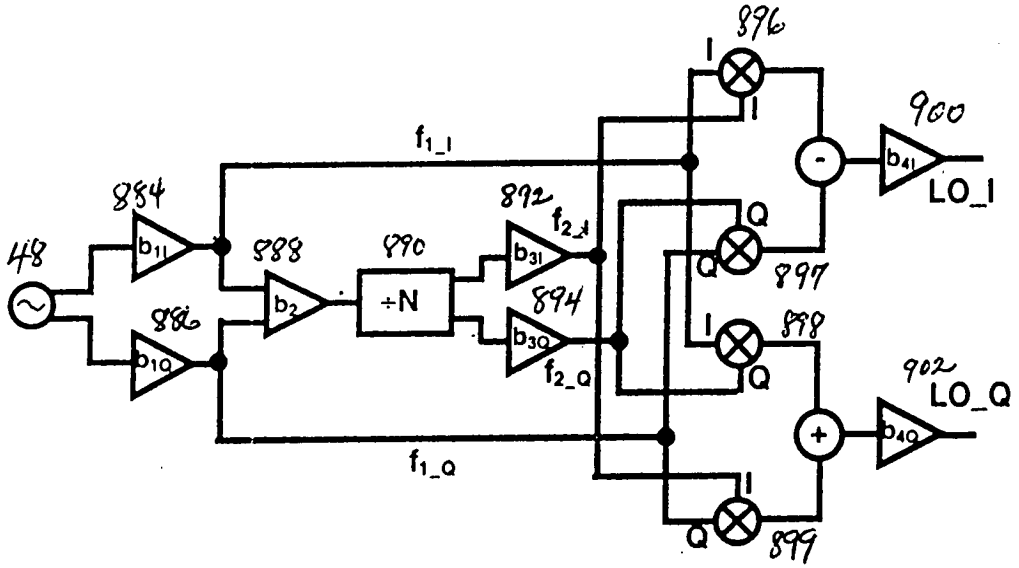

48
884
b_{1I}
b_{1Q}
888
b_2
÷N
890
892
f_{2_I}
b_{3I}
894
b_{3Q}
f_{2_Q}
f_{1_I}
f_{1_Q}
896
I
Q
897
898
899
900
b_{4I}
LO_I
902
b_{4Q}
LO_Q

FIG. 33

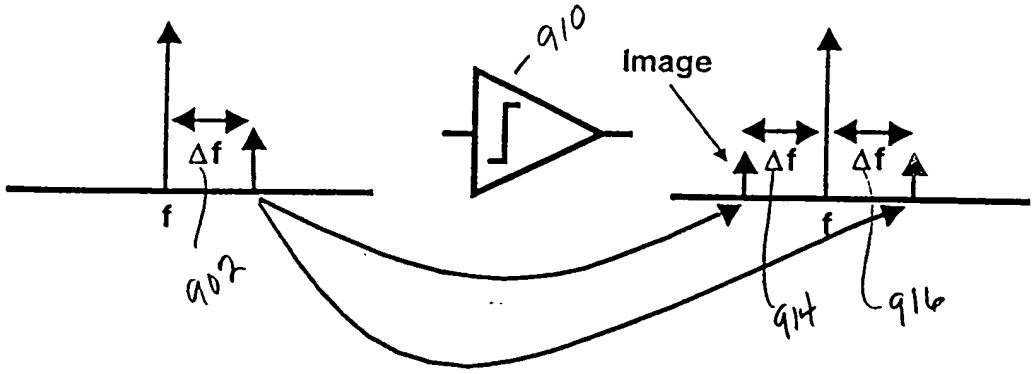


FIG. 33(a)

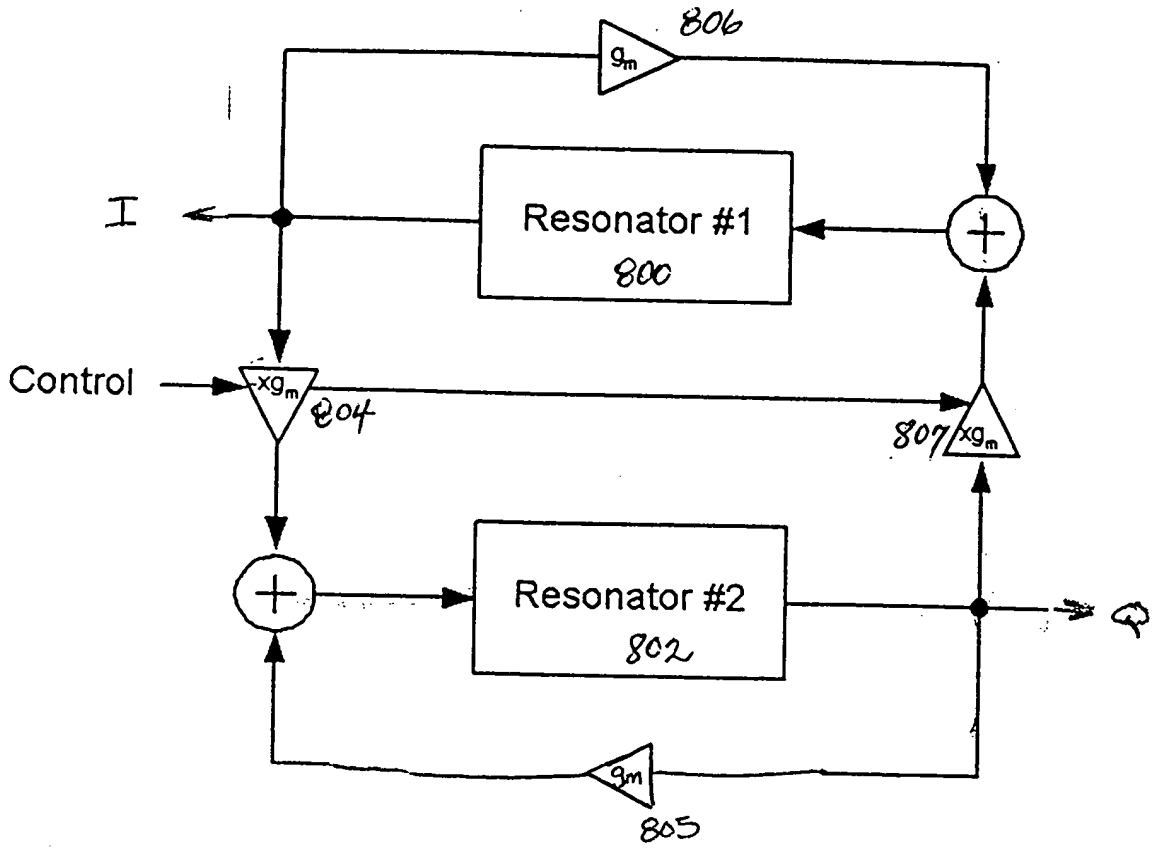

806
g_m
I
Resonator #1
800
Control
xg_m
804
807
xg_m
Resonator #2
802
Q
g_m
805

FIG. 34

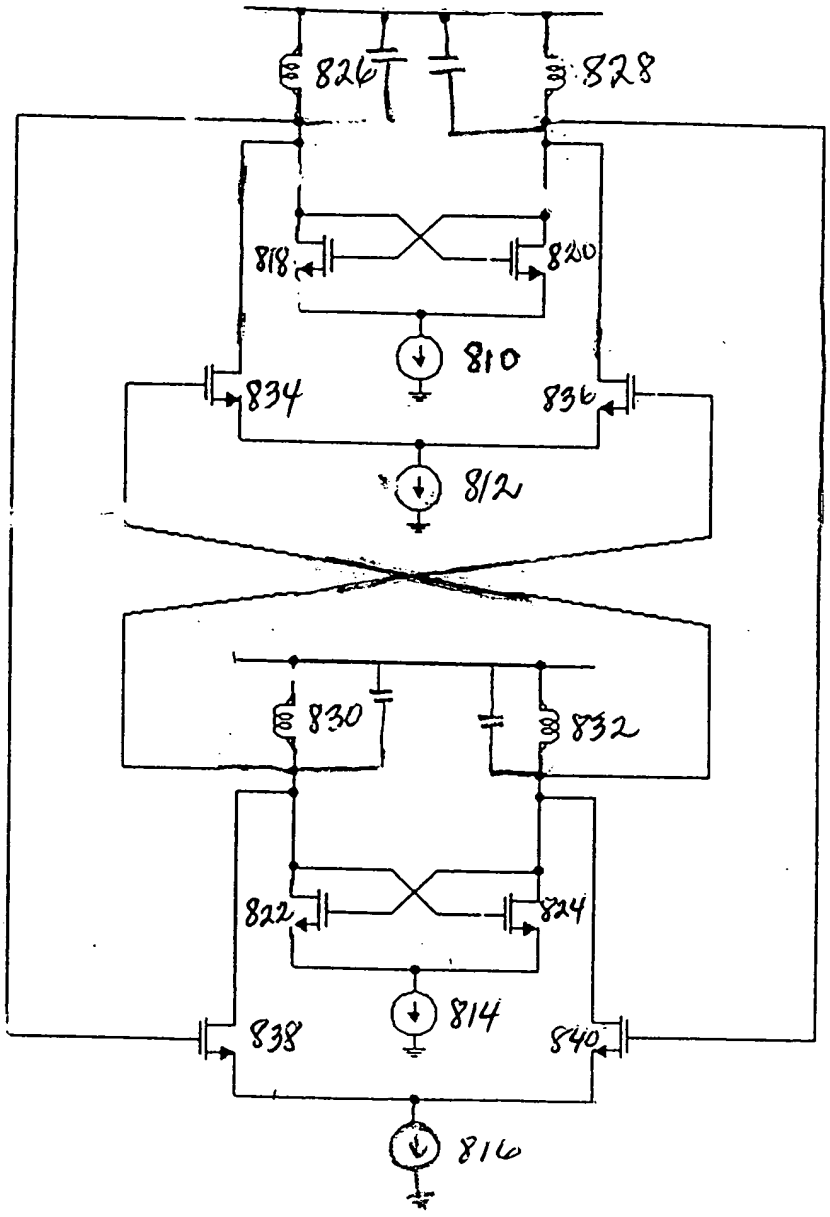
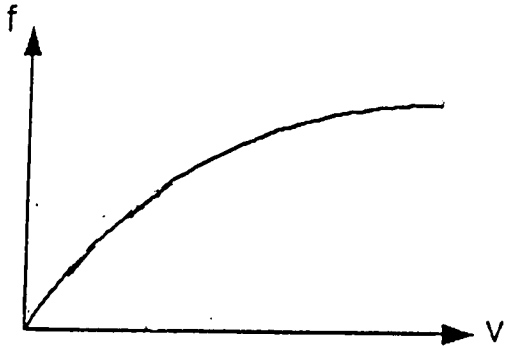
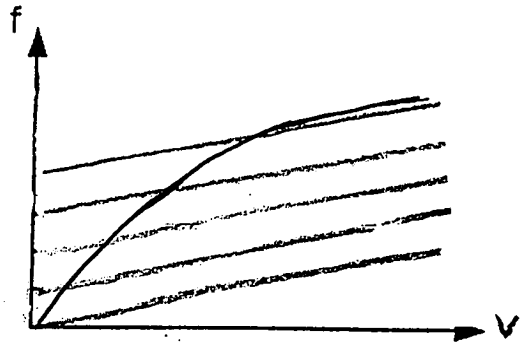


FIG. 35



Typical VCO Tuning Curve

FIG. 36(a)



Segmented VCO Tuning Curve

FIG. 36(b)

FIG. 37(a)

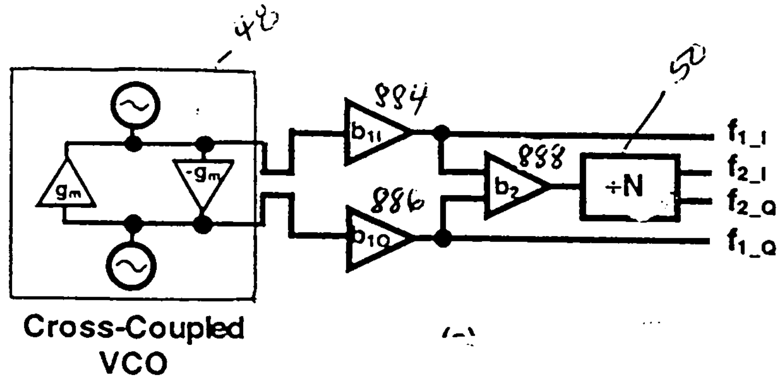
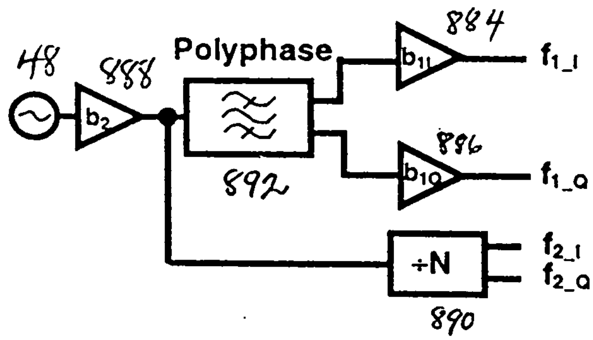


FIG. 37(b)



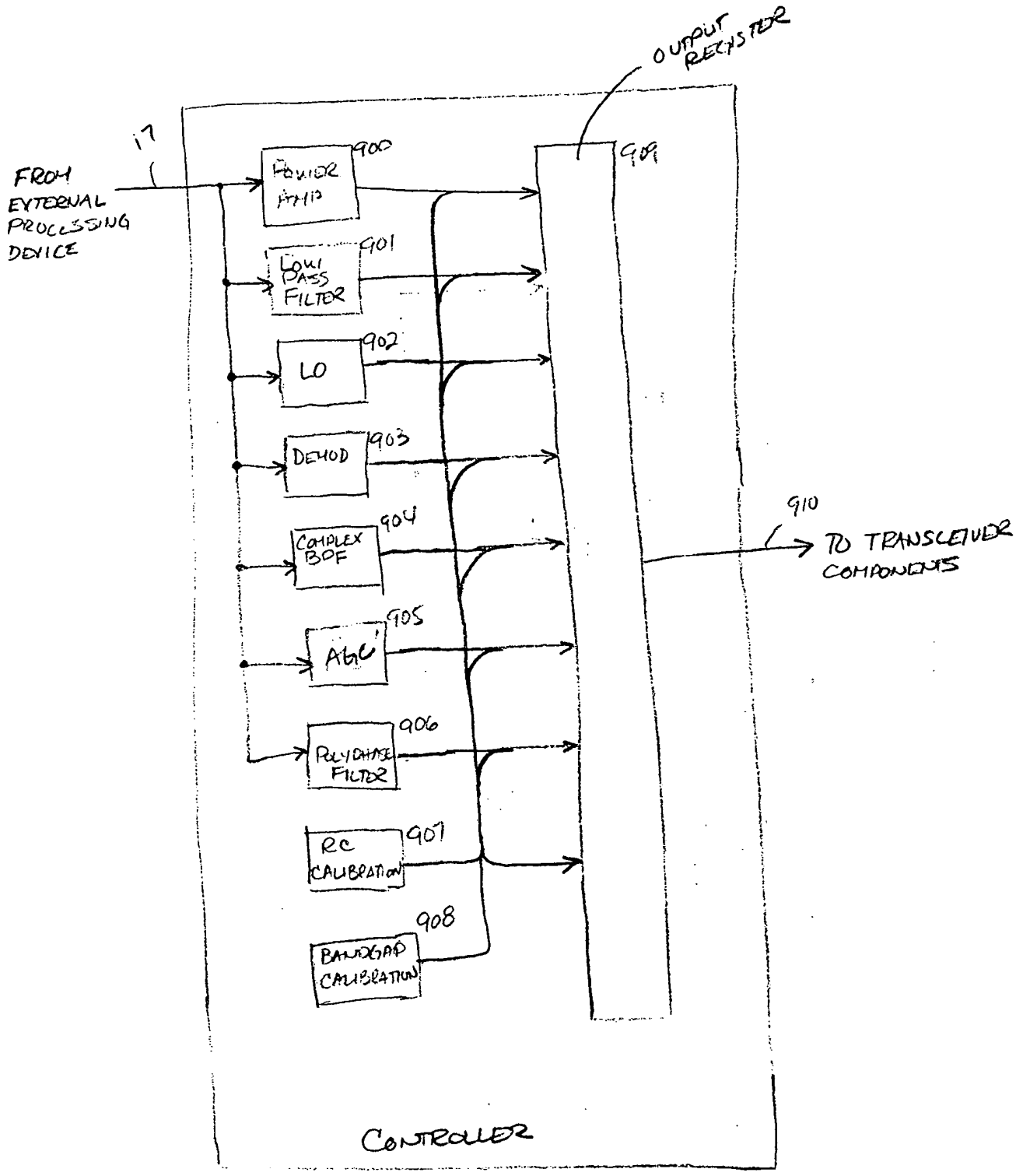

OUTPUT REGISTER
17
FROM EXTERNAL PROCESSING DEVICE
900
909
901
LOW PASS FILTER
902
LO
903
DEMOD
904
COMPLEX BPF
905
AGC
906
POLYPHASE FILTER
907
RC CALIBRATION
908
BANDGAP CALIBRATION
910
TO TRANSCEIVER COMPONENTS
CONTROLLER

FIGURE 38

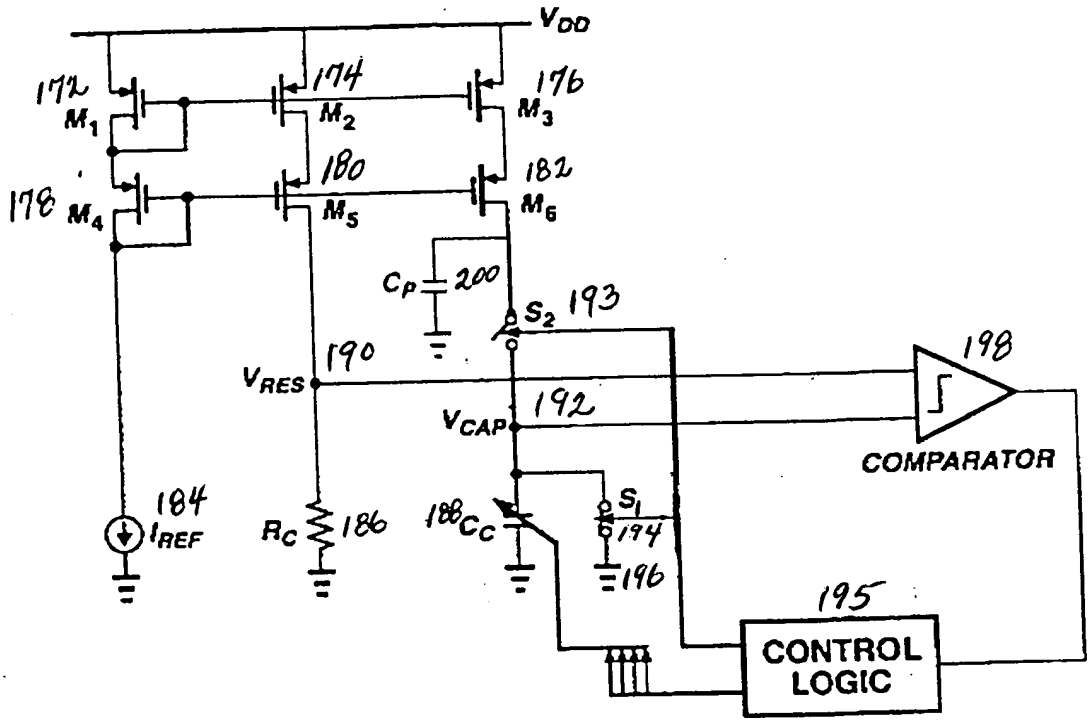

V_{DD}
172
M_1
174
M_2
176
M_3
178
M_4
180
M_5
182
M_6
C_P 200
S_2 193
190
V_{RES}
192
V_{CAP}
198
COMPARATOR
184
I_{REF}
R_C 186
188 C_C
S_1 194
196
195
CONTROL LOGIC

FIG. 39

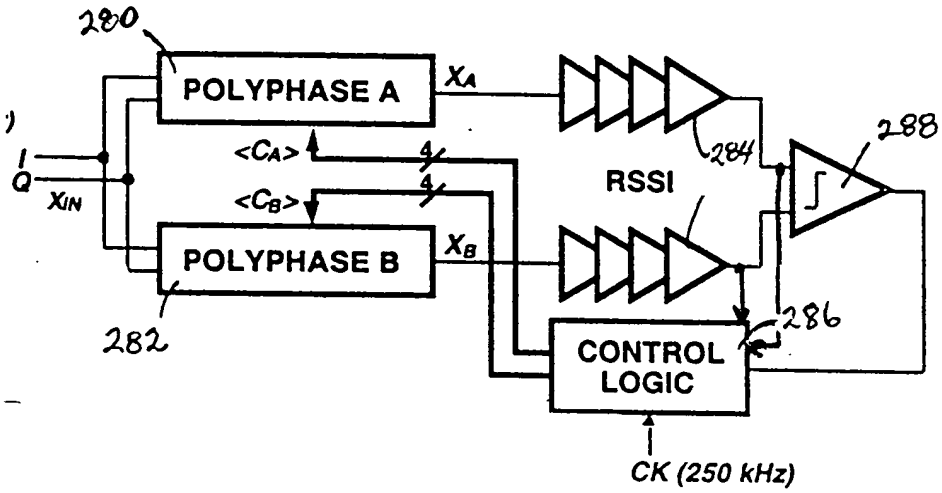

280
POLYPHASE A
X_A
$<C_A>$
4
I
Q
X_{IN}
$<C_B>$
4
RSSI
284
288
POLYPHASE B
X_B
282
286
CONTROL LOGIC
CK (250 kHz)

FIG. 40

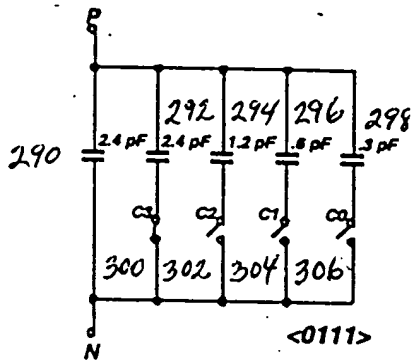

P
290
292
294
296
298
2.4 pF
2.4 pF
1.2 pF
.6 pF
.3 pF
C2
C2
C1
C0
300
302
304
306
N
<0111>

FIG. 41

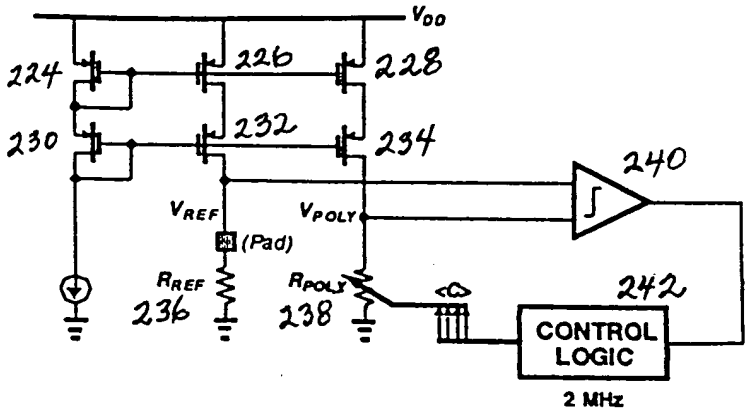

V_{DD}
224
226
228
230
232
234
240
V_{REF}
V_{POLY}
(Pad)
R_{REF}
236
R_{POLY}
238
<C>
242
CONTROL LOGIC
2 MHz

FIG. 42

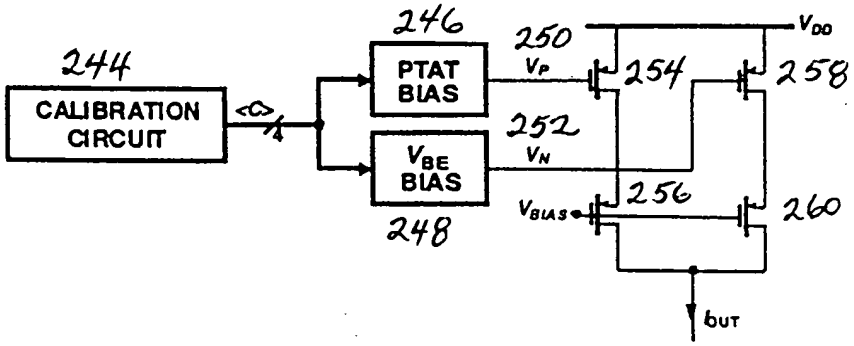

246
250
V_{DD}
244
PTAT BIAS
V_P
254
258
CALIBRATION CIRCUIT
<6>
252
V_N
V_{BE} BIAS
256
V_{BIAS}
260
248
b_{OUT}

FIG. 43

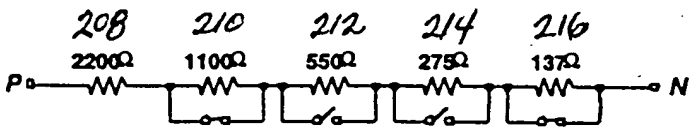


FIG. 44

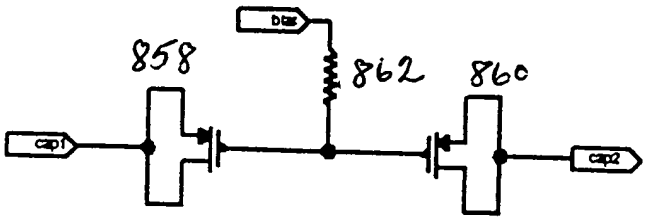


FIG. 45

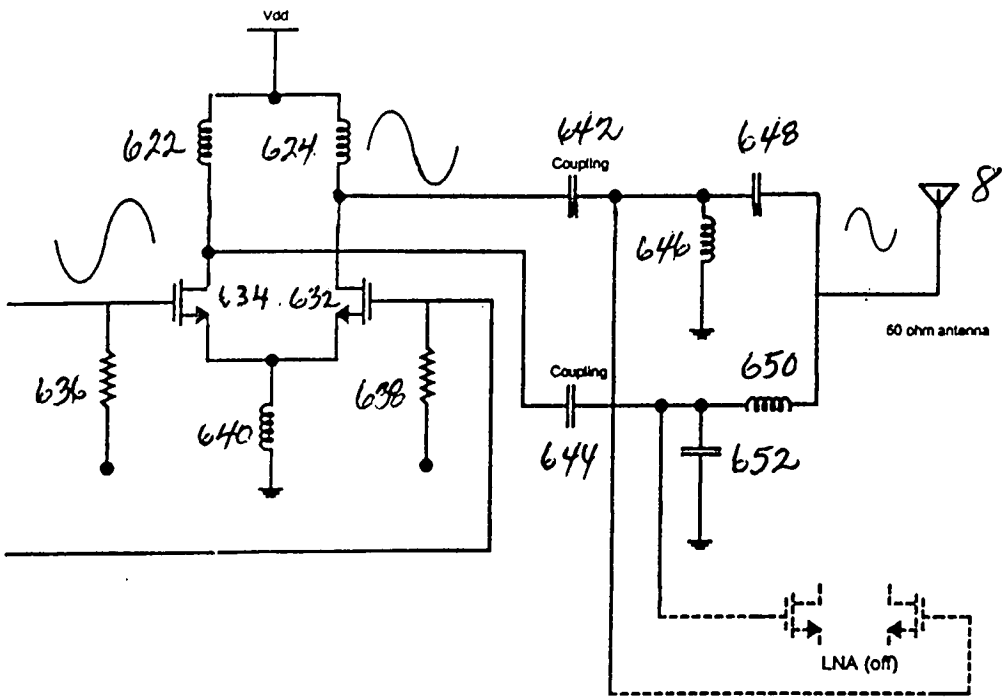

Vdd
622
624
642
Coupling
648
8
646
634
632
636
638
640
Coupling
650
644
652
60 ohm antenna
LNA (off)

FIG. 46

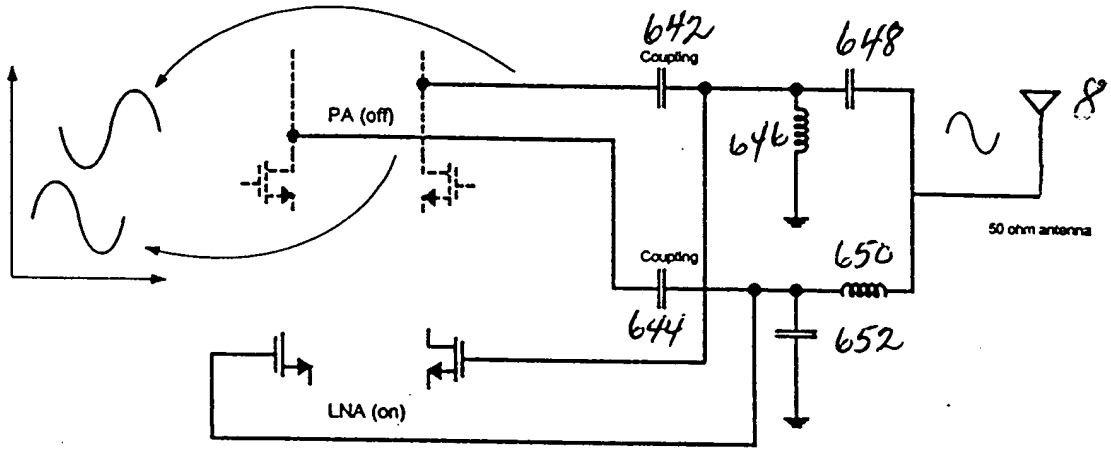

642
Coupling
648
PA (off)
646
8
50 ohm antenna
Coupling
650
644
652
LNA (on)

FIG. 47